NOAA-POES-IJPS/OSD-2002-0006R0UD0
October 30, 2002
DCN 0

# POES IJPS

# Polar-orbiting Operational Environmental Satellite (POES)

# IJPS System Requirements for Communication Services

## October 30, 2002


**Prepared by:**

**U.S. Department of Commerce**
**National Oceanic and Atmospheric Administration (NOAA)**
**National Environmental Satellite, Data, and Information Service (NESDIS)**

**NOAA/NESDIS**

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***POES Series***
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**CHANGE PAGE HISTORY**

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| 0 | Complete Document | Original baseline version of this document | See COMMENTS below |

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*EXAMPLES: A*Insert change pages 6.2-6 through 6.2-9 following page 6.2-5"*
*AReplace pages 3.4-1 through 3.4-10 with change pages 3.4-1 through 3.4-10b@*
*AReplace page 4.5-24 with change page 4.5-24; delete pages 4.5-25 through 4.5-30***"**

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# Preface

This document comprises the NOAA/NESDIS baseline publication of the Polar-orbiting Operational Environmental Satellite (POES) IJPS System Requirements for Communication Services, (October 30, 2002 issue). This document is Revision 0, DCN 0 (document number NOAA-POES-IJPS/OSD-2002-0006R0UD0).

This document identifies requirements for NOAA Communication Services for IJPS. The intent is to provide a baseline for future upgrades needed to perform Metop satellite related functions required to sustain the joint NOAA/EUMETSAT system called the Initial Joint Polar Satellite System (IJPS).

The initial version of the document was prepared by Mitretek Systems under Contract No. 50-SPAN-9-00009, Task Number, 56-SPNA-9-90002 (Task 2).

Publication of this document closes Document Configuration Change Request (DocCCR) # DocCCR-POES-Other-2002-0005, entitled Acceptance of IJPS SR for CS.

Future updates and revisions to this document will be produced and controlled by NOAA/NESDIS.

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# Acronyms and Abbreviations

| | |
|---|---|
| ABR | Available Bit Rate |
| AAS | Data Archive & Access System |
| AD | Applicable Document |
| AIP | AMSU Information Processor |
| AMSU | Advanced Microwave Sounding Unit |
| AOS | Acquisition of Signal |
| APT | Analog Picture Transmission |
| ASCAT | Advanced Scatterometer |
| ATM | Asynchronous Transfer Mode |
| AVHRR | Advanced Very High Resolution Radiometer |
| BER | Bit-Error-Rate |
| BGAC | Blind GAC |
| BGDS | Blind GDS |
| BHRPT | Blind NOAA HRPT |
| BMHRPT | Blind Metop HRPT |
| BMTC | Blind Metop Telecommand |
| BMTM | Blind Metop TM |
| BoD | Bandwidth on Demand |
| BTM | Blind NOAA TM |
| CBR | Constant Bit Rate |
| CCSDS | Consultative Committee for Space Data Systems |
| CDA | Control and Data Acquisition |
| CEMSCS | Central Environmental Satellite Computer System |
| CIR | Committed Information Rate |
| CGS | Core Ground Segment |
| CM | Configuration Management |
| COPS | Common Open Policy Service |
| CSDS | Circuit Switch Data Service |
| CSU | CDA/SOCC Upgrade |
| DiffServ | Differentiated Services |
| DMG | Data Management Gateway |
| DMSP | Defense Meteorological Satellite Program |
| DoD | Department of Defense |
| DOMSAT | Domestic satellite |
| DS | Digital Signal Level |
| DS0 | Digital Signal Level 0 (64 kbps) |
| DS1 | Digital Signal Level 1 (1.544 Mbps) |
| DTS | Dedicated Transmission Service |
| EPS | EUMETSAT Polar System |
| ESA | European Space Agency |
| EUMETSAT | European Organization for the Exploitation of Meteorological Satellites |
| FB | Fairbanks |

| | |
|---|---|
| FEP | Front End Processor |
| FIFO | First-In-First-Out |
| FR | Frame Relay |
| FTS2001 | Federal Telecommunications Services 2001 |
| F-T1 | Fractional T1 |
| GAC | Global Area Coverage |
| GDS | Global Data Stream |
| GOME | Global Ozone Monitoring Experiment |
| GRAS | Global navigation satellite system Receiver for Atmospheric Sounding |
| G/S | Ground Segment |
| GSA | U.S. General Services Administration |
| HRPT | High Resolution Picture Transmission |
| IASI | Infrared Atmospheric Sounding Interferometer |
| ID | Identification |
| IJPS | Initial Joint Polar-orbiting Operational Satellite System |
| IORD | Integrated Operational Requirements Document |
| IPS | Ingest and Preprocessing System |
| IRD | Interface Requirement Document |
| JORP | Joint Operations Rules and Procedures |
| kbps | Kilobits per second |
| kHz | kilo Hertz |
| LAC | Local Area Coverage |
| LAN | Local Area Network |
| LIFO | Last-In-First-Out |
| LOS | Loss of Signal |
| Mbps | Megabits per second |
| MCC | Mission Control Center |
| MD | Maryland, USA |
| Metop | Meteorological Operational |
| MHRPT | Metop HRPT |
| MHS | Microwave Humidity Sounder |
| MPLS | Multi-Protocol Label Switching |
| MSEC | Millisecond |
| MTC | Metop Telecommand |
| MTM | Metop Telemetry |
| N/A | Not Applicable |
| NOAA | National Oceanic and Atmospheric Administration |
| NTC | NOAA Telecommand |
| NPOESS | National Polar-orbiting Operational Environmental Satellite System |
| NRZ | Non Return to Zero |
| NPP | NPOESS Preparatory Project |
| NTC | NOAA Telecommand |
| NWS | National Weather Service |
| OSD | Office of System Development |
| OSI | Open Systems Interconnection |

| | |
|---|---|
| PACS | Polar Acquisition and Control System |
| PCDA | Polar Command and Data Acquisition |
| PCM | Pulse Code Modulation |
| PGD | Product Generation & Distribution System |
| PGS | POES Ground Segment |
| PIP | Program Implementation Plan |
| PM | Phase Modulation |
| POES | Polar-orbiting Operational Environmental Satellite |
| POP | Point of Presence |
| PSK | Phase Shift Key |
| PVC | Permanent Virtual Circuit |
| QoS | Quality of Service |
| QPSK | Quadrature Phase Shift Keying |
| RD | Reference Document |
| RFI | Request-For-Information |
| RFP | Request–For-Proposal |
| RSVP | Resource Reservations Protocol |
| SAF | Satellite Application Facility |
| SAIP | Stored AIP |
| SATCOM | Satellite Communication |
| SCC | Satellite Control Center |
| SCR | Sustained Cell Rate |
| SOCC | Satellite Operations Control Center |
| STIP | Stored TIP |
| SVC | Switched Virtual Circuit |
| TBC | To Be Confirmed |
| TBD | To Be Determined |
| TBS | To Be Supplied |
| TBW | To Be Written |
| TC | Telecommand |
| TDM | Time Division Multiplexing |
| TIP | TIROS Information Processor |
| TIROS | Television Infrared Observation Satellite |
| TM | Telemetry |
| UBR | Unspecified Bit Rate |
| UTC | Coordinated Universal Time (Same as GMT) |
| VBR | Variable Bit Rate |
| VHF | Very High Frequency |
| VPN | Virtual Private Network |
| WAN | Wide Area Network |
| WL | Wallops |

# 1.0 Introduction

## 1.1 Purpose

This document consolidates National Oceanic and Atmospheric Administration (NOAA) communications requirements between the elements of NOAA's ground segment and between NOAA and European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) ground segments in the Initial Joint Polar-orbiting Operational Satellite System (IJPS) timeframe. As applicable, requirements from higher level documents are restated in this document; e.g., from the Interface Requirements Documents (IRDs). Conflicts that arise will be handled by order of precedence (see Section 1.4).

## 1.2 Scope

NOAA and EUMETSAT signed a Memorandum of Agreement for IJPS in November 1998 for each agency to share resources to procure space hardware, to operate satellites, and to distribute environmental data collected by the satellites of each organization. The IJPS period is planned to occur between 2006 and 2015. During this period, NOAA will no longer be responsible for operating a two-polar satellite mission. Instead, EUMETSAT will launch, operate, and distribute environmental data from the Meteorological Operational (Metop) series of satellites that will be placed in a morning orbit. EUMETSAT will also provide blind orbit support for the NOAA Polar-orbiting Operational Environmental Satellite (POES). NOAA will continue to operate its afternoon POES satellite constellation and provide cross support for the Metop satellite. This document identifies the NOAA communication services requirements to enable POES blind orbit support by EUMETSAT and Metop cross support by NOAA, to make POES Global Area Coverage (GAC) data available to EUMETSAT, and to support NOAA collection of Metop global data from EUMETSAT.

## 1.3 Document Organization

- Section 1.4 – Lists the applicable documentation that provides source information to the scope of requirements on the POES system.
- Section 1.5 – Lists the reference documentation that provides input information to the scope of requirements on the POES system.
- Section 2 – Provides an overview of the POES communication services for IJPS.
- Section 3 – Provides the formal requirement statements.
- Section 4 – Provides key words with definitions
- Section 5 – Provides open issues.
- Appendices – Provide a requirements matrix and summary of the IJPS data volumes.

## 1.4 Applicable Documents

Table 1-1 presents a list of Applicable Documents (AD-#) that contain information and/or requirements that need to be applied for the successful completion of the IJPS program.

***Table 1-1. Applicable Documents***

| Doc # | Title | Reference Number | Issue | Date |
|---|---|---|---|---|
| AD-1 | Agreement Between the United States National Oceanic and Atmospheric Administration and the European Organisation for the Exploitation of Meteorological Satellites on an Initial Joint Polar-orbiting Operational Satellite System | | | 11/19/98 |
| AD-2 | Program Implementation Plan (PIP) for Cooperation Between NOAA and EUMETSAT on an Initial Joint Polar-Orbiting Operational Satellite System | EUM.EPS.MGT/980320 | 1 | 07/08/99 |
| AD-3 | EPS Core Ground Segment Interface Requirements on NOAA Ground Segment | NOAA-POES-IJPS/OSD-2001-00002R0UD0 | 2.2 | 11/13/01 |
| AD-4 | NOAA Interface Requirements on EPS Core Ground Segment | NOAA-POES-IJPS/OSD-2001-00003R0UD0 | 2.2 | 11/13/01 |
| AD-5 | EPS Core Ground Segment Generic File Transfer Interface Requirements Document | EPS/SYS/IRD/980191 | 2.2 | 11/01/00 |
| AD-6 | EPS Core Ground Segment to Operation Support Entities Interface Requirements Document | EPS/GGS/IRD/980426 | 2.2 | 24/24/01 |
| AD-7 | EPS Core Ground Segment to IASI-TEC Interface Requirements Document | EPS/GGS/IRD/980468 | 3 | 11/03/00 |
| AD-8 | POES System Requirements for IJPS | NO-IJ/OSD-99-0004-R0U0 | 1 | 4/15/02 |
| AD-9 | NOAA-N & -N' Satellite to Ground Interface, and Tech Memo | IS 23033284 | | 6/30/01 |
| AD-11 | HRPT/LRPT Direct Broadcast Services Specification | MO-DS-ESA-SY0048 EPS/SYS/SPE/95413 | 3 | 02/04/97 |
| AD-12 | EPS Encryption System Specification | MO-RS-ESA-SY-0049 EPS/SYS/SPE/95424 | 4 | 09/08/98 |
| AD-13 | Data Denial Implementation Plan (DDIP) | | 1 | 5/30/01 |
| AD-14 | EPS/NOAA Joint Operations Rules and Procedures | NOAA-POES-IJPS/OSD-2001-0004R0UDo | 1 | 11/30/01 |
| AD-15 | NOAA Ground Segment to EPS Ground Segment Interface Control Document | TBW | | |
| AD-16 | Metop Space to Ground Interface Specification | MO-IF-MMT-SY0001 | 4 | 07/26/99 |
| AD-17 | Metop Satellite to Ground Segment Interface Requirements | MO-IS-ESA-SY0025 | 2 | 2/1997 |
| AD-18 | Polar-orbiting Operational Environmental Satellite Ground Segment Upgrade Description (RDN-5) | NO-IJ/OSD-99-0005-R0U0 | 1 | 5/15/00 |
| AD-19 | Polar-orbiting Operational Environmental Satellite (POES) Ground Segment Command and Data Acquisition and Satellite Operations Control Center Requirements for IJPS | NOAA-POES/OSD-2001-00010-R0UD0 | 1 | 12/20/01 |

If conflicts are identified between requirements in this document and other IJPS documentation, the following order of precedence will be followed:

- Agreement Between the United States National Oceanic and Atmospheric Administration and the European Organisation for the Exploitation of Meteorological Satellites on an Initial Joint Polar-orbiting Operational Satellite System
- Program Implementation Plan (PIP) for the Cooperation between NOAA and EUMETSAT on an Initial Joint Polar-orbiting Operational Satellite System
- Polar-orbiting Operational Environmental Satellite System Requirements for Initial Joint Polar Satellite System (NO-IJ/OSD-99-0004)
- Polar Operational Environmental Satellite Ground Segment Upgrade Description & Requirements for Initial Joint Polar Satellite System (NO-IJ/OSD-99-0005)
- Initial Joint Polar-orbiting Operational Satellite System (IJPS) Communications Requirements (NO-IJ/OSD-99-0006)

## 1.5 Reference Documents

Table 1-2 presents a list of Reference Documents (RD-#) that provide additional useful information for program implementation.

***Table 1-2. Reference Documents***

| Doc # | Title | Reference Number | Issue | Date |
|---|---|---|---|---|
| RD-1 | EPS Core Ground Segment Requirements Document | EPS/GGS/REQ/95327 | Issue 5 Rev 0 | 11/12/00 |
| RD-2 | NOAA Baseline Polar-orbiting Operational Environmental Satellite (POES) Command and Data Acquisition (CDA) and Satellite Operations Control Center (SOCC) Equipment Configuration | NO-IJ/SO-99-0008R0U0 | #2 | 11/30/99 |
| RD-3 | Detailed Mission Requirements Document for NOAA -K, -L, and -M, DMT | | 2 | 05/1997 |
| RD-4 | Advanced TIROS-N Program, Programming and Control Handbook for NOAA-KLM | | | 03/16/98 |
| RD-5 | Polar Acquisition and Control System (PACS) Operations and Maintenance Manual | | | 12/1992 |
| RD-6 | Overview of NOAA - Polar Satellite System, The MITRE Corporation | | Rev 0 | 09/1994 |

# 2.0 System Overview

NOAA currently operates the Television Infrared Observation Satellite (TIROS) series of polar orbiting weather satellites. They monitor each satellite orbit and provide global area coverage (GAC) and local area coverage (LAC) for two missions; a morning mission and an afternoon mission. The TIROS satellites are in the K, L, and M capability stage. A follow-on satellite series (N and N') is expected to be launched in the 2003-2007 time frame. Details on the NOAA Polar-Orbiting Operational Environmental Satellite (POES) system are provided in AD-9 and RDs -3, -4, -5, and -6.

EUMETSAT, in coordination with the European Space Agency (ESA), has undertaken the development of the EUMETSAT Polar System (EPS). The EPS space components will consist of the Meteorological Operational (Metop) series of satellites; Metop 1, Metop 2, and Metop 3. Details on the EPS are provided in ADs -16 and -17.

NOAA and EUMETSAT have agreed to jointly operate their polar orbiting systems in the NOAA-N, N' and Metop-1, 2 period called IJPS. The IJPS, established through a cooperative agreement between NOAA and EUMETSAT, defines an integrated meteorological system providing global data coverage. EUMETSAT will assume responsibility for operating and distributing environmental data for the Metop satellite to meet the morning orbit mission, and NOAA will continue to be responsible for operating and distributing environmental data for the NOAA satellites to meet the afternoon orbit mission. The Metop satellites will accommodate NOAA instruments to provide continuity to the NOAA morning mission. The NOAA satellites will accommodate an EPS instrument to support the EUMETSAT afternoon mission. In addition, potential 'blind orbits,' i.e., orbits that can not be acquired by the satellite's nominal ground station(s), will be eliminated through agency cross support (including 'pass through' commanding). Cross support will also be provided upon request on a 'best effort' basis for other specified satellite passes (e.g., during contingencies). Commercial communication links will be used by the NOAA and EUMETSAT ground systems to exchange payload, telemetry, and command data. Figure 2-1 provides a high level graphical description of the IJPS system.

As shown in Figure 2-1, the NOAA Ground Segment includes the Control and Data Acquisition (CDA) stations, the Satellite Operations Control Center (SOCC), and the Central Environmental Satellite Computer System (CEMSCS). NOAA's two CDA stations are located in Fairbanks, Alaska, and Wallops Island, Virginia. The SOCC and CEMSCS are both located in Suitland, Maryland (MD).

The CDA stations currently acquire and record the NOAA satellite data and transmit it back to SOCC and CEMSCS for processing. The CDA stations also relay commands from the SOCC to the satellite. The SOCC is the centralized point for satellite command and control and troubleshooting. The SOCC also provides the scheduling and sustaining engineering functions. SOCC operations are accomplished predominately through the Polar Acquisition and Control System (PACS) (RD-5). While each CDA can provide short-term backup to the SOCC, the Wallops CDA had been designated as the primary backup SOCC for the NOAA satellites.

CEMSCS processes raw satellite data forwarded from the SOCC and performs quality control, data conditioning, and product generation for dissemination to the user community.

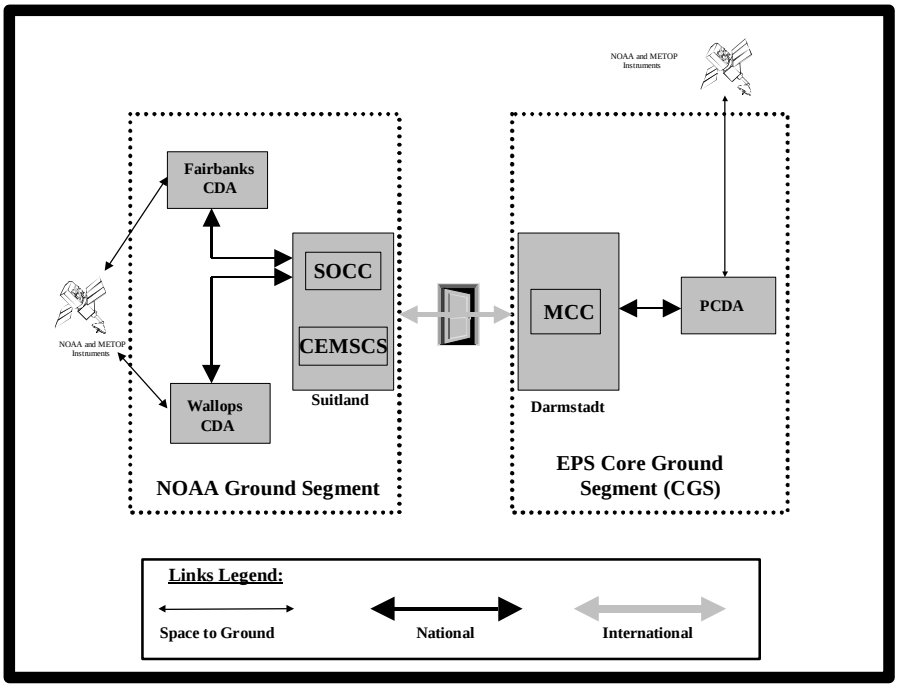


***Figure 2-1. IJPS System Overview***

The EPS Core Ground Segment (CGS) includes the Polar Command and Data Acquisition (PCDA) station and the Mission Control Center (MCC). The PCDA, located in Svalbard, Norway, will acquire NOAA and EUMETSAT meteorological payload data and spacecraft telemetry, and permit the NOAA and EUMETSAT control centers to command POES and Metop satellites, respectively. The MCC, located in Darmstadt, Germany, will function similarly to the NOAA SOCC. It will provide planning, scheduling, and monitoring and control for the Metop satellites. In addition, it will process data to the 1b or 1c Level. Further processing of the meteorological data and generation of product is to be provided by the Satellite Application Facilities (SAFs); the SAFs are outside the scope of the CGS.

As shown in Figure 2-1, the communication links can be generalized as Space-Ground links, International Communications links between ground segments, and National links between CDAs and control centers/processing centers. The Space-Ground links include X, S, L, and VHF band transmissions. Table 2-1 provides an overview of the data types that will be transmitted. Note: Stored AIP and stored TIP are recorded onboard the NOAA satellite and can be transmitted to the ground for anomaly resolution.

***Table 2-1. Data Type***

| NOAA | EUMETSAT |
|---|---|
| Command | |
| NOAA Telecommand (NTC) | METOP Telecommand (MTC) |
| Telemetry and Housekeeping | |
| High Resolution Picture Transmission (HRPT) | METOP Telemetry (MTM) |
| Advanced Microwave Sounding Unit (AMSU) Information Processor (AIP) | METOP HRPT (MHRPT) |
| TIROS Information Processor (TIP) | |
| Payload Data | |
| Global Area Coverage (GAC) | Global Data Stream (GDS) |
| Local Area Coverage (LAC) | |
| Stored AIP (SAIP) | |
| Stored TIP (STIP) | |

Further details on the data types can be found in ADs –9, –11, –16, and –17 and in RD-4. For example, NOAA employs Time Division Multiplexing (TDM) for telemetry and global data using fixed length words, minor frames, and major frames (AD-9). The command uplink uses the Command Uplink Request Format (RD-4). EUMETSAT has adopted Consultative Committee for Space Data Systems (CCSDS) packet telemetry standards for downlinking instrument sensor data from the Metop spacecraft to the ground. Metop Space Telecommand Packets (AD-16) are used on the S band uplink to command the Metop spacecraft.

# 3.0 Communication Services Requirements to Support IJPS

The POES Ground Segment (PGS) is divided into six primary functional elements for the purpose of allocating requirements. They are:

- Command & data acquisition element, located at the Fairbanks, Alaska, and Wallops, Virginia, stations.
- Satellite operations, control and health & safety monitoring element located at the SOCC in Suitland, Maryland.
- Data ingest and preprocessing (Level 1 product) element located at the CEMSCS in Suitland, Maryland.
- Product generation and distribution (Levels 2 & 3 products) element located at the OSDPD in Suitland.
- Long term data archive and access elements are located at NCDC, Asheville, N.C., NODC, Silver Spring, Md., and at SAA in Suitland, Md.
- The Communications (COMM) element provides the communications network infrastructure and connections between the Suitland interface and the Darmstadt interface, and among the PGS elements.

This section presents a consolidated set of requirements for the COMM element. To distinguish between communication requirements identified in the System Requirements Document and this document, the requirement ID is in the form: MCOM, <a.b.c.d.>-<number>", followed by the verification method and text paragraph(s); MCOM designates communications in the Metop timeframe. The verification methods are identified as follows:

- **Analysis:** An engineering assessment and/or mathematical process that may include computer modeling and/or simulation to determine compliance with specification requirements.
- **Demonstration:** Determination of properties and performance involving proof-by-doing.
- **Inspection:** Examination or measurement of product characteristics or the review of design, production or test documentation to determine compliance with specified requirements.
- **Test:** Exercise of hardware, software, or operations to measure quantitatively specified requirements

The requirements have been captured from NOAA and EUMETSAT documents (see Sections 1.3), legacy related requirements embedded in NOAA's current operations, and planned NOAA upgrades. Requirements are grouped as follows:

- **Functional** - Input, output, data transforms, calculations, external interfaces, communications, and special management information needs.
- **Performance** - External workloads, internal function workloads, throughput and response times, data quality, integrity, accuracy, system capacity, reliability, availability, maintainability, human workload and performance, growth, flexibility, expandability, and fault isolation and location.
- **Operational** - Human factors, including human-computer interfaces, system operational environment, system monitoring and configuration control, training, support capabilities, maintenance, logistics, facilities, safety, physical security, implementation sites, and operating/maintenance documentation.
- **Programmatic** - Requirements related to the program development facility and support requirements, special test requirements, installation and turnover schedules with customer, and development standards.
- **Special** - Requirements related to architectural constraints, design constraints, portability, and reusability.

In addition, the following definitions are used:

- **TBC** - to be confirmed: Open issue, exact value/quantity/implementation yet to be decided.
- **TBD** - to be determined: Open issue, under discussion.
- **TBS** - to be supplied: Open issue, under analysis.
- **TBW** - to be written: document under development.

## 3.1 Functional Requirements

MCOM-3.1-010 Demo

The Communications Element shall provide for telecommunications capabilities between the PGS elements, as required, to ensure the following: [PCOM-3.3.6.1-010]

- Data and information exchange
- Timeliness requirement as defined by each element
- Meet data transfer reliability as defined by each element

MCOM-3.1-020 Demo

The Communications Element network shall be sized based on the individual element needs for the data types, information and timeliness requirements (TBD). [PCOM-3.3.6.1-020]

MCOM-3.1-030 Demo

The Communications Element shall not disrupt existing data/information links between the PGS and external agencies/entities, including NWS and DOD, in the IJPS period. [PCOM-3.3.6.1-070]

MCOM-3.1-040 Demo

The Communications Element shall be responsible for providing, at the communications level, data exchange and interface compatibility among the PGS elements for data rates, data types, data quantity and modes of operation. [PCOM-3.3.6.1-040]

MCOM-3.1-050 Demo

The Communications Element shall exchange all satellite data flows with EUMETSAT through a single interface point (on each side of the Atlantic). The interface point is defined as NOAA in Suitland, MD and the EPS in Darmstadt, Germany. [PCOM-3.3.6.1-050]

MCOM-3.1-060 Demo

The Communications Element shall provide telecommunications capabilities for acquiring from the Darmstadt interface, transmitting to Suitland, and distributing to the current operational interfaces the following data types: [PCOM-3.3.6.1-050]

- NOAA GAC/SAIP/STIP in pipeline mode
- Metop global data in pipeline mode
- NOAA HRPT/AIP/TIP in throughput mode
- NOAA TC Echo in throughput mode
- Level 1 data from the EUMETSAT instruments on Metop using ftp (TBC)
- Cross-support and operations planning data using ftp (i.e, Generic File Transfer)

MCOM-3.1-065 Demo

The Communications Element shall make available one orbit buffers for GAC and GDS data acquired at the Darmstadt interface. *[Allocated to SOCC and IPS Elements respectively*] [PCOM-3.3.6.3-040]

MCOM-3.1-070 Demo

The Communications Element shall provide the capability to filter the Level 0 GDS data to provide any combination of instrument data for processing. [*Allocated to IPS Element*] [PCOM-3.3.6.1-050]

MCOM-3.1-080 Demo

The Communications Element shall provide telecommunications capabilities for transferring the NOAA satellite telecommands for NOAA blind orbits in throughput mode to the Darmstadt interface. [PCOM-3.3.6.1-060]

MCOM-3.1-090 Demo

The Communications Element shall provide telecommunications capabilities at the Suitland interface for receiving Metop satellite telecommands for Metop contingency orbits in throughput mode from Darmstadt. [PCOM-3.3.6.3-020]

MCOM-3.1-095 Demo

The Communications Element shall provide telecommunications capabilities between Suitland and Fairbanks for throughput of Metop telecommands and the capability to throughput an acknowledgement to the Suitland interface that the telecommand was received at Fairbanks. [PCOM-3.3.6.1-040, PCOM-3.3.6.3-010, CSU-CDA-3.2.4-0040]

MCOM-3.1-100 Demo

The Communications Element shall provide telecommunications capabilities at the Suitland interface to make available the following data types from the NOAA CDA stations *[Allocated to the Satellite Operations, Control and Health and Safety Monitoring Element]*: [PCOM-3.3.6.1-010]

- NOAA GAC/SAIP/STIP in pipeline mode (Wallops and Fairbanks)
- Metop global data in pipeline mode (Fairbanks only)
- Metop telemetry in throughput mode (Fairbanks only)
- Metop command acknowledgements (Fairbanks only)

MCOM-3.1-105 Demo

In case of a GAC/SAIP/STIP or GDS data acquisition failure at the Suitland interface, the Communications Element shall provide the capability to retry establishing the data transfer if the cumulated communication downtime for that orbit is less than the time margin available on the communication link (i.e., before the start of the data flow from the next orbit) between the Suitland interface and the EPS CGS. [PCOM-3.3.6.1-040]

MCOM-3.1-110 Demo

The Communications Element shall provide a capability for data buffering GAC and GDS data at the Suitland interface in compliance with the performance requirements as defined in MICOM-3.1-105. [PCOM-3.3.6.3-030]

MCOM-3.1-115 Demo

The Communications Element shall provide a capability for data buffering management over telecommunications services at the Suitland interface in compliance with the performance requirements as defined in MICOM-3.1-105. [PCOM-3.3.6.3-030]

MCOM-3.1-120 Demo

The Communications Element shall make one orbit buffers for GAC and GDS data available at the Suitland interface for transmission. [*Allocated to SOCC Element*] [PCOM-3.3.6.3-030]

MCOM-3.1-125 Demo

In the event of a communication outage, the Communications Element shall restart the GDS/GAC transmission at the point the data stream would have been if an outage had not occurred. (TBC) *[Allocated to SOCC Element*] [PCOM-3.3.6.3-030]

MCOM-3.1-130 Demo

The Communications Element shall provide telecommunications capabilities between Fairbanks and Suitland for distribution of the following data types: [PCDA-3.3.1.1-030, PCOM-3.3.6.1-010]

- Metop telemetry in throughput mode (with time stamp appended)
- Metop global data (with time stamp and quality bit appended)
- Metop HRPT data

MCOM-3.1-140 Demo

The Communications Element shall provide telecommunications capabilities between SOCC and the Suitland interface for distribution of GAC data. [PCOM-3.3.6.1-010]

(Note: The existing NOAA GAC/SAIP/STIP distribution from the CDAs to SOCC is not a POES IJPS requirement.)

MCOM-3.1-150 Demo

The Communications Element shall provide telecommunications capabilities between Wallops and Suitland for distribution of Metop HRPT data. [PCOM-3.3.6.1-010, PCDA-3.3.1.1-030]

MCOM-3.1-160 Demo

The Communications Element shall provide the capability to exchange auxiliary and coordination data (e.g., calibration data) between NOAA Suitland and the EPS CGS using ftp (i.e., Generic File Transfer interface). *[Allocated to IPS Element*] [PCOM-3.3.6.1-010]

MCOM-3.1-170 Demo

The Communications Element shall provide the capability to conduct voice communications between NOAA in Suitland and the EUMETSAT EPS CGS. [PCOM-3.3.6.1-010]

MCOM-3.1-180 Demo

The Communications Element shall provide telecommunications capabilities for acquiring Level 1 products from IASI, ASCAT, GRAS, and GOME at the Darmstadt interface and transmitting them back to Suitland. [PCOM-3.3.6.1-050]

MCOM-3.1-190 Demo

The Communications Element shall provide telecommunications capabilities for distribution of GAC and GDS from the Darmstadt interface to current POES GAC users (e.g., DoD). [PCOM-3.3.6.1-010]

## 3.2 Performance

MCOM-3.2-010 Analysis

The Communications Element shall deliver within timeliness requirements 99.4% (TBC) (measured over any 30-day period) of the IJPS POES GAC or SAIP or STIP data received at Suitland to the Suitland interface. [PSYS-3.1.4-020, PCOM-3.3.6.4-010, CSU-CR-3.1.9-0070]

MCOM-3.2-020 Test

For the interface between the SOCC and the Suitland interface, the Communications Element shall be allocated one (TBC) second of the 120 seconds to provide the first GAC data at the Suitland interface no later than 2 minutes after loss of signal. [PSYS-3.1.4-020, PCOM-3.3.6.4-010, CSU-CR-3.1.12-0010]

MCOM-3.2-030 Test

For the interface between the SOCC and the Suitland interface, the Communications Element shall be allocated one (TBC) second to complete delivery of the last bit of IJPS GAC data to the Suitland Interface no later than 100 minutes after completion of the GAC dump. [PSYS-3.1.4-020, PCOM-3.3.6.4-010, CSU-CR-3.1.12-0020]

MCOM-3.2-040 Test

For the interface between the SOCC and the Suitland interface, the Communications Element shall be sized so that during split mission, two full orbits of GAC data can be made available at the Suitland interface within timeliness requirements. [PCOM-3.3.6.3-020]

MCOM-3.2-050 Test

For the interface between the NOAA CDA and the Suitland interface, the Communications Element shall be allocated one (TBC) second of the 120 seconds to provide the first GDS data no later than 2 minutes after download completion. [PCOM-3.3.6.4-020, CSU-CR-3.1.12-0050]

MCOM-3.2-060 Test

For the interface between the Fairbanks CDA and the Suitland interface, the Communications Element shall be allocated one (TBC) second to complete delivery of the last bit of GDS data to the Suitland Interface no later than 100 minutes after download completion. [PCOM-3.3.6.4-020, CSU-CR-3.1.12-0060]

MCOM-3.2-070 Test

For the interface between the Fairbanks CDA and the Suitland interface, the Communications Element shall be allocated 0.25 (TBC) seconds of the 1 second to uplink (at Fairbanks) a Metop TC completely received at the Suitland interface. [PCOM-3.3.6.4-020, CSU-CR-3.1.12-0100]

MCOM-3.2-080 Test

The Communications Element shall be allocated 0.25 (TBC) of the 1 second to make available at the Suitland interface a Metop TM frame completely acquired at the Fairbanks CDA station. [PCOM-3.3.6.4-020, CSU-CR-3.1.12-0080]

MCOM-3.2-090 Analysis

The maximum downtime of the Communications Element shall not exceed TBD minutes for the TM transport chain to ensure the maximum downtime between the Suitland interface and the Fairbanks CDA will not exceed 100 minutes. [PCOM-3.3.6.4-020, CSU-CR-3.1.9-0050]

MCOM-3.2-100 Analysis

The maximum downtime of the Communications Element shall not exceed TBD minutes for the TC transport chain to ensure the maximum downtime between the Suitland interface and the Fairbanks CDA will not exceed 100 minutes. [PCOM-3.3.6.4-020, CSU-CR-3.1.9-0060]

MCOM-3.2-110 Analysis

The maximum downtime of the Communications Element shall not exceed 60 minutes (TBC) for the GDS transport chain to ensure the maximum downtime for the GDS acquisition chain between the Fairbanks CDA and the Suitland interface will not exceed 360 minutes. [PCOM-3.3.6.4-020, CSU-CR-3.1.9-0040]

MCOM-3.2-120 Analysis

The Communications Element shall make available 99.8% of the GDS data transferred between the Fairbanks CDA station and the Suitland interface over any 30 day period. [PCOM-3.3.6.4-020, CSU-CDA-3.2.7-0140, CSU-SOC-3.3.10-0160]

MCOM-3.2-130 Analysis

The Communications Element shall make available 99.8% of the TM data transferred between the Fairbanks CDA station and the Suitland interface over any 30 day period. [PCOM-3.3.6.4-020, CSU-CDA-3.2.7-0130, CSU-SOC-3.3.10-0170]

MCOM-3.2-140 Analysis

The Communications Element shall make available 99.8% of the TC data transferred between the Fairbanks CDA station and the Suitland interface over any 30 day period. [PCOM-3.3.6.4-020, CSU-CDA-3.2.7-0070, CSU-SOC-3.3.10-0180]

MCOM-3.2-150 Analysis/Demo

The Communications Element shall provide a guaranteed minimum bandwidth of TBD and a maximum bandwidth of 3.7 Mbps (TBC) for Metop contingency cross-support to provide GDS data flow within the specified performance requirements. [PCOM-3.3.6.1-010]

MCOM-3.2-160 Analysis

The maximum downtime of the Communications Element shall not exceed 60 minutes (TBC) for the GAC data delivery chain to ensure the maximum downtime for the GAC acquisition chain between the Fairbanks CDA and the Suitland interface will not exceed 360 minutes. [PCOM-3.3.6.4-030]

MCOM-3.2-170 Analysis/Demo

The Communications Element shall size the link(s) between the Suitland and Darmstadt interfaces to accommodate the following: [PCOM-3.3.6.4-040]

- Data volume per satellite per orbit
    - GAC/SAIP-STIP – 458.33 Mbits/11.75 Mbits
    - GDS – 21,420 Mbits
    - GAC/SAIP-STIP One Orbit Buffer – 458.33 Mbits/11.75 Mbits
    - GDS One Orbit Buffer – 21,420 Mbits
    - IASI/ASCAT/GRAS/GOME Level 1 Product - TBD
- Data rate:
    - NOAA HRPT/or subset of HRPT – 665.4 kbps/30 kbps (TBC)
    - NOAA AIP/TIP – 16.64/8.32 kbps
    - NOAA TC – 2 kbps
    - Metop TC – 2 kbps
    - Metop TM – 4.096 Kbps

MCOM-3.2-180 Analysis/Demo

The Communications Element shall size the link(s) between Fairbanks and Suitland to accommodate the following: [PCDA-3.3.1.1-030, PCOM-3.3.6.4-040]

- Data volume per satellite per orbit
    - GDS – 21,420 Mbits
- Data rate:
    - Metop TC – 2 kbps
    - Metop TM – 4.096 Kbps
    - Metop HRPT/subset of Metop HRPT – 3 Mbps/667 Kbps when only AVHRR sync delta, AIP, and TIP are required. (TBC)

MCOM-3.2-190 Analysis/Demo

The Communications Element shall size the link(s) between Wallops and Suitland to accommodate a Metop HRPT data rate at 3 Mbps/or subset of Metop HRPT at 667 Kbps. (TBC) [PCDA-3.3.1.1-030]

MCOM-3.2-200 Test

For the telecommunication links, the Communications Element shall provide the following minimum Quality of Service (QOS): [PCOM-3.3.6.1-010]

- Bit error rate: $10^{-6}$ without error correction/$10^{-9}$ with error correction (TBC)
- Packet error rate: Domestically $\leq$0.5%; Internationally $\leq$1.0% (TBC)

## 3.3 Operational Requirements

MCOM-3.3-010 Demo

In the event of a SOCC failure, the Communications Element shall provide communication services (i.e., traffic re-routing) to support a geographically separate back-up SOCC at the Wallops CDA. [PCOM-3.3.6.1-010]

## 3.4 Programmatic

MCOM-3.4-010 Demo

The Communications Element shall network and ensure interface compatibility between the following PGS element interfaces as required by each element for IJPS. (TBD) [PCOM-3.3.6.3-010]

- COMM↔SOCC
- COMM↔IPS
- SOCC↔IPS
- CDAs↔SOCC
- FCDA↔WCDA

MCOM-3.4-015 Analysis

The Communication Element shall not provide communications between the Ingest and Preprocessing System (IPS) Element, Product Generation & Distribution System (PGD) Element, and the Data Archive & Access System (AAS) or to the World Weather Buillding. [PCOM-3.3.6.3-010]

MCOM-3.4-020 Demo

The Communications Element shall ensure complete interface compatibility between the Suitland and Darmstadt interface points for the following types of data reception and transmission: [PCOM-3.3.6.3-020]

- Commanding
- Global Data
- TM
- Voice
- Coordination/Auxiliary Data

## 3.5 Special

TBD

# 4.0 Open Issues

## 4.1 TBC

MCOM-3.1-125 Demo

In the event of a communication outage, the Communications Element shall restart the GDS/GAC transmission at the point the data stream would have been if an outage had not occurred (TBC). [PCOM-3.3.6.3-030]

MCOM-3.2-010 Analysis

The Communications Element shall deliver within timeliness requirements 99.4% (TBC) (measured over any 30-day period) of the IJPS POES GAC or SAIP or STIP data received at Suitland to the Suitland interface. [PSYS-3.1.4-020, PCOM-3.3.6.4-010, CSU-CR-3.1.9-0070]

MCOM-3.2-020 Test

For the interface between the SOCC and the Suitland interface, the Communications Element shall be allocated one (TBC) second of the 120 seconds to provide the first GAC data at the Suitland interface no later than 2 minutes after loss of signal. [PSYS-3.1.4-020, PCOM-3.3.6.4-010, CSU-CR-3.1.12-0010]

MCOM-3.2-030 Test

For the interface between the SOCC and the Suitland interface, the Communications Element shall be allocated one (TBC) second to complete delivery of the last bit of IJPS GAC data to the Suitland Interface no later than 100 minutes after completion of the GAC dump. [PSYS-3.1.4-020, PCOM-3.3.6.4-010, CSU-CR-3.1.12-0020]

MCOM-3.2-050 Test

For the interface between the NOAA CDA and the Suitland interface, the Communications Element shall be allocated one (TBC) second of the 120 seconds to provide the first GDS data no later than 2 minutes after download completion. [PCOM-3.3.6.4-020, CSU-CR-3.1.12-0050]

MCOM-3.2-060 Test

For the interface between the Fairbanks CDA and the Suitland interface, the Communications Element shall be allocated one (TBC) second to complete delivery of the last bit of GDS data to the Suitland Interface no later than 100 minutes after download completion. [PCOM-3.3.6.4-020, CSU-CR-3.1.12-0060]

MCOM-3.2-070 Test

For the interface between the Fairbanks CDA and the Suitland interface, the Communications Element shall be allocated 0.25 (TBC) seconds of the 1 second to uplink (at Fairbanks) a Metop TC completely received at the Suitland interface. [PCOM-3.3.6.4-020, CSU-CR-3.1.12-0100]

MCOM-3.2-080 Test

The Communications Element shall be allocated 0.25 (TBC) of the 1 second to make available at the Suitland interface a Metop TM frame completely acquired at the Fairbanks CDA station. [PCOM-3.3.6.4-020, CSU-CR-3.1.12-0080]

MCOM-3.2-110 Analysis

The maximum downtime of the Communications Element shall not exceed 60 minutes (TBC) for the GDS transport chain to ensure the maximum downtime for the GDS acquisition chain between the Fairbanks CDA and the Suitland interface will not exceed 360 minutes. [PCOM-3.3.6.4-020, CSU-CR-3.1.9-0040]

MCOM-3.2-150 Analysis/Demo

The Communications Element shall provide a guaranteed minimum bandwidth of TBD and a maximum bandwidth of 3.7 Mbps (TBC) for Metop contingency cross-support to provide GDS data flow within the specified performance requirements. [PCOM-3.3.6.1-010]

MCOM-3.2-170 Analysis/Demo

The Communications Element shall size the link(s) between the Suitland and Darmstadt interfaces to accommodate the following: [PCOM-3.3.6.4-040]

- Data rate:
    - NOAA HRPT/or subset of HRPT – 665.4 kbps/30 kbps (TBC)

MCOM-3.2-180 Analysis/Demo

The Communications Element shall size the link(s) between Fairbanks and Suitland to accommodate the following: [PCDA-3.3.1.1-030, PCOM-3.3.6.4-040]

- Data rate:
    - Metop HRPT/subset of Metop HRPT – 3 Mbps/667 Kbps when only AVHRR sync delta, AIP, and TIP are required. (TBC)

MCOM-3.2-190 Analysis/Demo

The Communications Element shall size the link(s) between Wallops and Suitland to accommodate a Metop HRPT data rate at 3 Mbps/or subset of Metop HRPT at 667 Kbps. (TBC) [PCDA-3.3.1.1-030]

MCOM-3.2-200 Test

For the telecommunication links, the Communications Element shall provide the following Quality of Service (QOS): [PCOM-3.3.6.1-010]

- Bit error rate: $10^{-6}$ without error correction/$10^{-9}$ with error correction (TBC)
- Packet error rate: Domestically $\leq$0.5%; Internationally $\leq$1.0% (TBC)

## 4.2 TBD

MCOM-3.1-020 Demo

The Communications Element network shall be sized based on the individual element needs for the data types, information and timeliness requirements (TBD). [PCOM-3.3.6.1-020]

MCOM-3.2-090 Analysis

The maximum downtime of the Communications Element shall not exceed TBD minutes for the TM transport chain to ensure the maximum downtime between the Suitland interface and the Fairbanks CDA will not exceed 100 minutes. [PCOM-3.3.6.4-020, CSU-CR-3.1.9-0050]

MCOM-3.2-100 Analysis

The maximum downtime of the Communications Element shall not exceed TBD minutes for the TC transport chain to ensure the maximum downtime between the Suitland interface and the Fairbanks CDA will not exceed 100 minutes. [PCOM-3.3.6.4-020, CSU-CR-3.1.9-0060]

MCOM-3.2-150 Analysis/Demo

The Communications Element shall provide a guaranteed minimum bandwidth of TBD and a maximum bandwidth of 3.7 Mbps (TBC) for Metop contingency cross-support to provide GDS data flow within the specified performance requirements. [PCOM-3.3.6.1-010]

MCOM-3.2-170 Analysis/Demo

The Communications Element shall size the link(s) between the Suitland and Darmstadt interfaces to accommodate the following: [PCOM-3.3.6.4-040]

- Data volume per satellite per orbit
    - IASI/ASCAT/GRAS/GOME Level 1 Product - TBD

MCOM-3.4-010 Demo

The Communications Element shall network and ensure interface compatibility between the following PGS element interfaces as required by each element for IJPS. (TBD) [PCOM-3.3.6.3-010]

- COMM↔SOCC
- COMM↔IPS
- SOCC↔IPS
- CDAs↔SOCC
- FCDA↔WCDA

The entire Section 3.5, entitled Special, is also TBD.

## 4.3 TBW

There are currently no TBW requirements.

# 5.0 Keywords with Definitions

**Blind orbit** – Orbit that can not be acquired by the satellite's nominal ground station(s); i.e., Fairbanks and Wallops for NOAA and Svalbard for Metop.

**Contingency support** – Orbit that could not be acquired by the satellite nominal ground station. The reasons for not being able to acquire the data include failure scenarios and cross-support for satellite operations upon request for specific operations.

**Cross Support** – Provide commanding access, housekeeping telemetry and global data acquisition to / from the other Agency's satellites for those orbits which are not visible from their CDA station(s) and on request for specific operations (e.g. launch and early orbits, commissioning phase, contingency…).

**One orbit buffer** – One complete data download of global data stored for the N+1 orbit period of time covering the N orbital data.

**Pipeline mode** – Data of one orbit is continuously transmitted, processed and distributed within the time of the next orbit.

**Throughput mode** – Data are transmitted without any other delay than required for the transmission itself and the data throughput IN equals the data throughput OUT.

# Appendix A. Requirements Matrix

| Requirement ID | Requirement Statement | Source Requirements | Allocated Requirements | Verification Method | Comments |
|---|---|---|---|---|---|
| MCOM-3.1-010 | The Communications Element shall provide for telecommunications capabilities among the PGS elements to ensure the following:<br>• Data and information exchange<br>• Timeliness requirement as defined by each element<br>• Meet data transfer reliability as defined by each element | RDN-4, PCOM-3.3.6.1-010 | | Demo | |
| MCOM-3.1-020 | The Communications Element network shall be sized based on the individual element needs for the data types, information and timeliness requirements. (TBD) | RDN-4, PCOM-3.3.6.1-020 | | Demo | |
| MCOM-3.1-030 | The Communications Element shall not disrupt existing data/information links between the PGS and external agencies/entities, including NWS and DOD, in the IJPS period. | RDN-4, PCOM-3.3.6.1-070 | | Demo | |
| MCOM-3.1-040 | The Communications Element shall be responsible for providing, at the communications level, data exchange and interface compatibility among the PGS elements for data rates, data types, data quantity and modes of operation | RDN-4, PCOM-3.3.6.1-040 | | Demo | |
| MCOM-3.1-050 | The Communications Element shall exchange all satellite data flows with EUMETSAT through a single interface point (on each side of the Atlantic) referred to as a “Single Door.” The “Single Door” is defined as the SOCC/CEMSCS in Suitland, MD and the EPS CGS in Darmstadt, Germany | RDN-4, PCOM-3.3.6.1-050 | | Demo | |
| MCOM-3.1-060 | The Communications Element shall provide telecommunications capabilities for acquiring from the Darmstadt interface, transmitting to Suitland, and distributing to the current operational interfaces the following data types:<br>• NOAA GAC/SAIP/STIP in pipeline mode<br>• Metop global data in pipeline mode<br>• NOAA HRPT/AIP/TIP in throughput mode<br>• NOAA TC Echo in throughput mode<br>• Level 1 data from EUMETSAT instruments on Metop | RDN-4, PCOM-3.3.6.1-050 | | Demo | |

| Requirement ID | Requirement Statement | Source Requirements | Allocated Requirements | Verification Method | Comments |
|---|---|---|---|---|---|
| MCOM-3.1-065 | The Communications Element shall make available in Suitland one orbit buffers for GAC and GDS data acquired at the Darmstadt interface. | RDN-4, PCOM-3.3.6.3-040 | | Demo | |
| MCOM-3.1-070 | The Communications Element shall provide the capability to filter the Level 0 GDS data to provide any combination of instrument data for processing. | RDN-4, PCOM-3.3.6.1-050 | | Demo | |
| MCOM-3.1-080 | The Communications Element shall provide telecommunications capabilities for transferring to the Darmstadt interface the following data types.<br>• NOAA satellite telecommands for NOAA blind orbits in throughput mode<br>• MHS instrument and telemetry data from NOAA N, N' | RDN-4, PCOM-3.3.6.1-060 | | Demo | |
| MCOM-3.1-090 | The Communications Element shall provide telecommunications capabilities at the Suitland interface for receiving Metop satellite telecommands for Metop contingency orbits in throughput mode from Darmstadt. | RDN-4, PCOM-3.3.6.3-020 | | Demo | |
| MCOM-3.1-095 | The Communications Element shall provide telecommunications capabilities between Suitland and Fairbanks for throughput of Metop telecommands and the capability to throughput an acknowledgement to the Suitland interface that the telecommand was received at Fairbanks. | RDN-4, PCOM-3.3.6.1-040, PCOM-3.3.6.3-010; RDN-10, CSU-CDA-3.2.4-0040 | | Demo | |
| MCOM-3.1-100 | The Communications Element shall provide telecommunications capabilities at the Suitland interfaces to make available the following data types from the NOAA CDA stations:<br>• NOAA GAC/SAIP/STIP in pipeline mode (Wallops and Fairbanks)<br>• Metop global data in pipeline mode (Fairbanks only)<br>• Metop telemetry in throughput mode (Fairbanks only)<br>• NOAA command acknowledgements (Fairbanks only) | RDN-4, PCOM-3.3.6.1-010 | Satellite Operations, Control and Health and Safety Monitoring Element | Demo | |
| MCOM-3.1-105 | In case of a GAC/SAIP/STIP or GDS data acquisition failure at the Suitland interface, the Communications Element shall provide the capability to retry establishing the data transfer if the cumulated communication downtime for that orbit is less than the margin available on the communication link between the Suitland interface and the EPS CGS | RDN-4, PCOM-3.3.6.1-040 | | Demo | |

| Requirement ID | Requirement Statement | Source Requirements | Allocated Requirements | Verification Method | Comments |
|---|---|---|---|---|---|
| MCOM-3.1-110 | The Communications Element shall provide a capability for data buffering GAC and GDS data at the Suitland interface in compliance with the performance requirements. | RDN-4, PCOM-3.3.6.3-030 | | Demo | |
| MCOM-3.1-115 | The Communications Element shall provide a capability for data buffering management over telecommunications services at the Suitland interface in compliance with the performance requirements. | RDN-4, PCOM-3.3.6.3-030 | | Demo | |
| MCOM-3.1-120 | The Communications Element shall make one orbit buffers for GAC and GDS data available at the Suitland interface for transmission. | RDN-4, PCOM-3.3.6.3-030 | | Demo | |
| MCOM-3.1-125 | In the event of a communication outage, the Communications Element shall restart the GDS/GAC transmission at the point the data stream would have been if an outage had not occurred | RDN-4, PCOM-3.3.6.3-030 | | Demo | |
| MCOM-3.1-130 | The Communications Element shall provide telecommunications capabilities between Fairbanks and Suitland for distribution of the following data types:<br>• Metop telemetry in throughput mode (with time stamp appended)<br>• Metop global data (with time stamp and quality bit appended)<br>• Metop HRPT data | RDN-4, PCDA-3.3.1.1-030, PCOM-3.3.6.1-010 | | Demo | |
| MCOM-3.1-140 | The Communications Element shall provide telecommunications capabilities between SOCC and the Suitland interface for distribution of GAC data. | RDN-4**,** PCOM-3.3.6.1-010 | | Demo | |
| MCOM-3.1-150 | The Communications Element shall provide telecommunications capabilities between Wallops and Suitland for distribution of Metop HRPT data. | RDN-4**,** PCOM-3.3.6.1-010, PCDA-3.3.1.1-030 | | Demo | |
| MCOM-3.1-160 | The Communications Element shall provide the capability to exchange auxiliary and coordination data (e.g., calibration data) between NOAA Suitland and the EPS CGS using ftp (i.e., Generic File Transfer interface). | RDN-4**,** PCOM-3.3.6.1-010 | IPS Element | Demo | |
| MCOM-3.1-170 | The Communications Element shall provide the capability to conduct voice communications between NOAA in Suitland and the EUMETSAT EPS CGS. | RDN-4**,** PCOM-3.3.6.1-010 | | Demo | |
| MCOM-3.1-180 | The Communications Element shall provide telecommunications capabilities for acquiring Level 1 products from IASI, ASCAT, GRAS, and GOME at the Darmstadt interface and transmitting them back to Suitland. | RDN-4**,** PCOM-3.3.6.1-050 | | Demo | . |

| Requirement ID | Requirement Statement | Source Requirements | Allocated Requirements | Verification Method | Comments |
|---|---|---|---|---|---|
| MCOM-3.1-200 | The Communications Element shall provide telecommunications capabilities for distribution of GAC and GDS from the Darmstadt interface to current POES GAC users (e.g., DoD). | RDN-4**,** PCOM-3.3.6.1-010 | | Demo | |
| MCOM-3.2-010 | The Communications Element shall deliver within timeliness requirements 99.4% (measured over any 30-day period) of the IJPS POES GAC or SAIP or STIP data received at Suitland to the Suitland interface. | RDN-4, PSYS-3.1.4-020, PCOM-3.3.6.4-010; RDN-10, CSU-CR-3.1.9-0070 | | Anaylsis | |
| MCOM-3.2-020 | For the interface between the SOCC and the Suitland interface, the Communications Element shall be allocated one (TBC) second of the 120 seconds to provide the first GAC data at the Suitland interface no later than 2 minutes after loss of signal. | RDN-4, PSYS-3.1.4-020, PCOM-3.3.6.4-010, RDN-10, CSU-CR-3.1.12-0010. | | Test | |
| MCOM-3.2-030 | For the interface between the SOCC and the Suitland interface, the Communications Element shall be allocated one (TBC) second to complete delivery of the last bit of IJPS GAC data to the Suitland Interface no later than 100 minutes after completion of the GAC dump. | RDN-4, PSYS-3.1.4-020, PCOM-3.3.6.4-010; RDN-10, CSU-CR-3.1.12-0020 | | Test | |
| MCOM-3.2-040 | For the interface between the SOCC and the Suitland interface, the Communications Element shall size the communications so that during split mission, two full orbits of GAC data can be made available at the Suitland interface within timeliness requirements. | RDN-4, PCOM-3.3.6.3-020 | | Test | |
| MCOM-3.2-050 | For the interface between the NOAA CDA and the Suitland interface, the Communications Element shall be allocated one (TBC) second of the 120 seconds to provide the first GDS data no later than 2 minutes after download completion. | RDN-4, PCOM-3.3.6.4-020; RDN-10, CSU-CR-3.1.12-0050 | | Teset | |
| MCOM-3.2-060 | For the interface between the Fairbanks CDA and the Suitland interface, the Communications Element shall be allocated one (TBC) second to complete delivery of the last bit of GDS data to the Suitland Interface no later than 100 minutes after download completion. | RDN-4, PCOM-3.3.6.4-020; RDN-10, CSU-CR-3.1.12-0060 | | Test | |
| MCOM-3.2-070 | For the interface between the Fairbanks CDA and the Suitland interface, the Communications Element shall be allocated 0.25 (TBC) seconds of the 1 second to uplink (at Fairbanks) a Metop TC completely received at the Suitland interface. | RDN-4, PCOM-3.3.6.4-020; RDN-10, CSU-CR-3.1.12-0100 | | Test | |

| Requirement ID | Requirement Statement | Source Requirements | Allocated Requirements | Verification Method | Comments |
|---|---|---|---|---|---|
| MCOM-3.2-090 | The maximum downtime of the Communications Element shall not exceed TBD minutes for the TM transport chain to ensure the maximum downtime between the Suitland interface and the Fairbanks CDA will not exceed 100 minutes. | RDN-4, PCOM-3.3.6.4-020, RDN-10, CSU-CR-3.1.9-0050 | | Analysis | |
| MCOM-3.2-100 | The maximum downtime of the Communications Element shall not exceed TBD minutes for the TC transport chain to ensure the maximum downtime between the Suitland interface and the Fairbanks CDA will not exceed 100 minutes. | RDN-4, PCOM-3.3.6.4-020; RDN-10, CSU-CR-3.1.9-0060 | | Analysis | |
| MCOM-3.2-110 | The maximum downtime of the Communications Element shall not exceed 60 minutes (TBC) for the GDS transport chain to ensure the maximum downtime for the GDS acquisition chain between the Fairbanks CDA and the Suitland interface will not exceed 360 minutes. | RDN-4, PCOM-3.3.6.4-020; RDN-10, CSU-CR-3.1.9-0040 | | Analysis | |
| MCOM-3.2-120 | The Communications Element shall make available 99.8% of the GDS data transferred between the Fairbanks CDA station and the Suitland interface over any 30 day period. | RDN-4, PCOM-3.3.6.4-020; RDN-10, CSU-CDA-3.2.7-0140, CSU-SOC-3.3.10-0160 | | Analysis | |
| MCOM-3.2-130 | The Communications Element shall make available 99.8% of the TM data transferred between the Fairbanks CDA station and the Suitland interface over any 30 day period. | RDN-4, PCOM-3.3.6.4-020; RDN-10, CSU-CDA-3.2.7-0130, CSU-SOC-3.3.10-0170 | | Analysis | |
| MCOM-3.2-140 | The Communications Element shall make available 99.8% of the TC data transferred between the Fairbanks CDA station and the Suitland interface over any 30 day period. | RDN-4, PCOM-3.3.6.4-020; RDN-10, CSU-CDA-3.2.7-0070, CSU-SOC-3.3.10-0180 | | Analysis | |
| MCOM-3.2-150 | The Communications Element shall provide a guaranteed minimum bandwidth of TBD and a maximum bandwidth of 3.7 Mbps (TBC) for Metop contingency cross-support to provide GDS data flow within the specified performance requirements. | RDN-4, PCOM-3.3.6.1-010 | | Analysis, Demo | |
| MCOM-3.2-160 | The maximum downtime of the Communications Element shall not exceed 60 minutes (TBC) for the GAC data delivery chain to ensure the maximum downtime for the GAC acquisition chain between the Fairbanks CDA and the Suitland interface will not exceed 360 minutes. | RDN-4, PCOM-3.3.6.4-030 | | Analysis | |

| Requirement ID | Requirement Statement | Source Requirements | Allocated Requirements | Verification Method | Comments |
|---|---|---|---|---|---|
| MCOM-3.2-170 | The Communications Element shall size the link(s) between the Suitland and Darmstadt interfaces to accommodate the following:<br>• Data volume per satellite per orbit<br>o GAC/SAIP-STIP – 458.33 Mbits/11.75 Mbits<br>o GDS – 21,420 Mbits<br>o IASI/ASCAT/GRAS/GOME Level 1 Product - TBD<br>• Data rate:<br>o NOAA HRPT/or subset of HRPT – 665.4 kbps/30 kbps (TBC)<br>o NOAA AIP/TIP – 16.64/8.32 kbps<br>o NOAA TC – 2 kbps<br>o Metop TC – 2 kbps<br>o Metop TM – 4.096 Kbps | RDN-4, PCOM-3.3.6.4-040 | | Analysis, Demo | |
| MCOM-3.2-180 | The Communications Element shall size the link(s) between Fairbanks and the Suitland interfaces to accommodate the following:<br>• Data volume per satellite per orbit<br>o GDS – 21,420 Mbits<br>• Data rate:<br>o Metop TC – 2 kbps<br>o Metop TM – 4.096 Kbps<br>o Metop HRPT/subset of Metop HRPT – 3 Mbps/667 Kbps when only AVHRR sync delta, AIP, and TIP are required. (TBC) | RDN-4, PCOM-3.3.6.4-040, PCDA-3.3.1.1-030 | | Analysis, Demo | |
| MCOM-3.2-190 | The Communications Element shall size the link(s) between Wallops and Suitland to accommodate a Metop HRPT data rate at 3 Mbps/or subset of Metop HRPT at 667 Kbps. (TBC) | RDN-4, PCDA-3.3.1.1-030 | | Analysis, Demo | |
| MCOM-3.2-200 | For the telecommunication links, the Communications Element shall provide the following minimum Quality of Service (QOS):<br>• Bit error rate: $10^{-6}$ without error correction/$10^{-9}$ with error correction (TBC)<br>• Packet error rate: Domestically $\leq$0.5%; Internationally $\leq$1.0% (TBC) | RDN-4, PCOM-3.3.6-010 | | Test | |
| MCOM-3.3-010 | In the event of a SOCC failure, the Communications Element shall provide communication services (i.e., traffic re-routing) to support a geographically separate back-up SOCC at the Wallops CDA. | RDN-4, PCOM-3.3.6.1-010 | | Demo | |

| Requirement ID | Requirement Statement | Source Requirements | Allocated Requirements | Verification Method | Comments |
|---|---|---|---|---|---|
| MCOM-3.4-010 | The Communications Element shall network and ensure interface compatibility between the following PGS element interfaces as required by each element for IJPS. (TBD)<br>• COMM↔SOCC<br>• COMM↔IPS<br>• SOCC↔IPS<br>• CDAs↔SOCC<br>• FCDA↔WCDA | RDN-4, PCOM-3.3.6.3-010 | | Demo | |
| MCOM-3.4-015 | The Communication Element shall not provide communications between the Ingest and Preprocessing System (IPS) Element, Product Generation & Distribution System (PGD) Element, and the Data Archive & Access System (AAS) or to the World Weather Buillding. | RDN-4, PCOM-3.3.6.3-010 | | Analysis | |
| MCOM-3.4-020 | The Communications Element shall ensure complete interface compatibility between the Suitland and Darmstadt interface points for the following types of data reception and transmission:<br>• Commanding<br>• Global Data<br>• TM<br>• Voice<br>• Coordination/Auxiliary Data | RDN-4, PCOM-3.3.6.3-020 | | Demo | |

# Appendix B. IJPS Satellite Data Volume Summary

| Data Type | Quantity | Space Segment Data Rate to CDA | Data Aging (End-to-End Recorder Duration) | Orbit Acquisition Window at CDA | Data Volume Per Orbit | Transmission Mode |
|---|---|---|---|---|---|---|
| | | Kbps | Minutes | Minutes | Mbits | |
| **NOAA OPERATIONS** | | | | | | |
| **NOAA Normal Satellite Data** | | | | | | |
| HRPT | 1 | 665.4 | N/A | 15 | N/A | Throughput |
| GAC-DTR | 1 | 2661.6 | 115 | 2.87 | 458.33 | Burst |
| LAC-DTR | 3 | 2661.6 | 115 | 2.87 | 1,374.98 | Burst |
| STIP or SAIP | 1 | 332.6 | 600 or 300 | 5.60 | 111.75 | Burst |
| **NOAA Virtual Satellite Data** | | | | | | |
| HRPT | 1 | 665.4 | N/A | 15 | N/A | Throughput |
| GAC-DTR | 1 | 2661.6 | 115 | 2.87 | 458.33 | Burst |
| **NOAA Narrowband Data** | | | | | | |
| NOAA-AIP/TIP | 1 | 16.64/8.32 | N/A | 15 | N/A | Throughput |
| NOAA-TC | 1 | 2 | N/A | 15 | N/A | Throughput |
| **METOP OPERATIONS** | | | | | | |
| **METOP Normal Satellite Data** | | | | | | |
| MHRPT | 1 | 3,500 | N/A | 15 | 3,150 | Throughput |
| GDS | 1 | 70,000 | 100 | 5.10 | 21,420 | Pipeline |
| METOP-TM | 1 | 4.096 | N/A | 15 | N/A | Throughput |
| **METOP Virtual Satellite (0.25)** | | | | | | |
| GDS | 1 | 70000 | 100 | 1.28 | 5,355 | Pipeline |
| **METOP Narrowband Data** | | | | | | |
| METOP-TC | 1 | 2 | N/A | 15 | N/A | Throughput |

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